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Abstract: When immigrants experience "nationality discrimination" in the labor market, *ceteris paribus* their earnings are lower than native-born workers because they were born abroad. The challenge to testing for nationality discrimination is that the native/immigrant earnings gap will very likely also be influenced by productivity differences driven by incomplete assimilation of immigrants, as well as the possibility of racial or gender discrimination. There is relatively little empirical literature, and virtually no theoretical literature, on this type of discrimination. In this study, a model of nationality discrimination where customer prejudice and native/immigrant productivity differences jointly influence the earnings gap is presented. We derive an extension of Becker's *Market Discrimination Coefficient* (MDC), applied to the case of nationality discrimination when there are productivity differences. A number of novel implications are obtained. We find, for example, that the MDC depends upon relative immigrant productivity and relative immigrant labor supply. We test the model on data for hitters and pitchers in Major League Baseball, an industry with a history of immigration, potential for customer discrimination, and clean, detailed micro-data on worker productivities and race. OLS and decomposition methods are used to estimate the extent of discrimination. We find no compelling evidence of discrimination in the hitter group, but evidence of *ceteris paribus* underpayment of immigrant pitchers. While our test case is for a particular industry, our theoretical model, empirical specifications, and general research design, are quite generalizable to many other labor markets.

Theme: Discrimination with respect to birthplace
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I. Introduction

It is well established in the literature on immigrant earnings that immigrants, especially those who have been in the host country only for a short time, are paid differently than their native-born peers. In most countries, for example, immigrants have lower wage rates compared to natives. The literature provides two basic explanations for native/immigrant earnings differences. First, there could be productivity differences resulting from immigrants having: (a) lower "standard" qualifications -- years of schooling, years of experience, etc; and/or (b) lower levels of host country human capital, i.e. lack of full assimilation. Second, there could be discrimination against immigrants, what is often called "nationality discrimination."[1] If immigrants suffer nationality discrimination, they are *ceteris paribus* paid less than their native-born peers. One reason is prejudice against immigrants by host country residents. The challenge to estimating nationality discrimination is to separate the effects of productivity differences from the effects of nationality discrimination on the native-immigrant earnings gap. As Nielsen, et al (2004) point out, "…when analyzing immigrant wage gaps in the presence of potential discrimination, it is important to *disentangle* the assimilation effect from a potential discrimination effect due to ethnicity…" (p. 859; our italics for emphasis).

The literature has not yet resolved this "disentangling" problem for several reasons. First, the problem has not been analyzed theoretically. The literature on assimilation, beginning with Chiswick (1978) and Borjas (1985, 1987), has been very helpful in clarifying how incomplete assimilation accounts for productivity differences between natives and immigrants. However, this literature has generally not analyzed how assimilation influences the earnings gap when immigrants also experience nationality discrimination. We lack a theoretical understanding of how productivity differences and nationality discrimination *jointly* influence native/immigrant earnings differences. Second, researchers

[1] A third explanation is that there could be native/immigrant differences in labor supply. For example, immigrants may have lower wage elasticities of supply and/or lower reservation wages. The literature has generally not pursued this explanation, though.

have often chosen test cases where data constraints make the separation of an assimilation effect from a discrimination effect difficult. A common problem is that data on the quality of immigrant human capital is often difficult to obtain. Another problem, emphasized by Bodvarsson and Fuess (2008), is that because many U.S. immigrants are non-white and because many studies do not control for race, available estimates of nationality discrimination could be biased because of missing controls for race. Consequently, we still know very little about the contribution of nationality discrimination to the native/immigrant wage gap.

We contend that to properly address the "disentangling" problem pointed out by Nielsen et al (2004), two hurdles must be overcome. First, a theoretical model of production where natives and immigrants are distinct inputs and where immigrants experience discrimination must be articulated. This model would be in contrast to the standard model of discrimination where majority and minority workers are perfect substitutes. As the assimilation literature would strongly argue, a presumption of perfect substitution between natives and immigrants is highly inappropriate because of imperfect transferability of human capital across borders. Second, proper empirical verification of a nationality discrimination model requires a test case where there are (i) highly accurate and detailed micro-data on native and immigrant worker productivities; and (ii) one can adequately control for the potentially confounding effects of race (or gender).

In this paper, we strive to overcome both these hurdles. We present a theory of tastes-based nationality discrimination using a model of production where natives and immigrants are imperfect substitutes. We derive a number of novel implications, which are then tested on a data set from an industry which is highly convenient for testing hypotheses about native/immigrant differences in pay – U.S. Major League Baseball. Major League Baseball is an industry with a long history of immigrant employment and where detailed and accurate data on player and firm performance are available. While this test case is selected because it is a convenient natural experiment for studying nationality discrimination, we wish to emphasize that our model and test are generalizable to many other labor markets.

The remainder of this paper is organized as follows. In the next subsection, we discuss the concept of nationality discrimination in more detail and then do an assessment of what the literature has to say about it. Our theoretical model is presented in section II. In Section III, we present evidence from tests of some of our model's implications. Section IV offers concluding remarks.

What is nationality discrimination and what does the literature on native/immigrant earnings differences have to say about it?

There is a voluminous literature on racial and gender discrimination in the labor market, which dates back to the pioneering works of Gary Becker (1971) and Kenneth Arrow (1973).[2] It is well known that labor market discrimination can take place with respect to other personal attributes such as age, religious affiliation, sexual orientation, weight, accent, or speech patterns. Another attribute that could induce discriminatory treatment is a worker's nativity status. Nationality discrimination occurs when, *ceteris paribus*, immigrants are paid less because they were born outside of the host country. This type of discrimination could be driven by prejudice (taste discrimination), imperfect information (statistical discrimination), or institutional factors.[3] In this study, we will focus on nationality discrimination due to prejudice.

There could be many reasons for prejudice against immigrants. Anecdotal information about nationality discrimination has been prevalent for many years. There are age-old jokes about U.S. immigrants from Ireland, Italy, and other countries regarding their mannerisms, attitudes, ways of life, etc. These sorts of jokes may be reflective of nationality discrimination. Native-born workers may harbor resentment towards immigrants because they perceive that immigrants take jobs from them. Native-born consumers may harbor biases against particular countries and value goods made by

[2] For expository surveys of this literature, see Cain (1986) and Altonji and Blank (1999).
[3] For a thorough comparison and contrasting of different theories of labor market discrimination, see Cain (1986).

workers from those countries less.[4] Prejudiced employers may have biases against hiring workers from particular countries. Nationality discrimination could occur in tandem with racial or gender discrimination. For example, if non-white U.S. immigrants are paid differently from white persons born in the U.S., the differential treatment could reflect both racial discrimination and nationality discrimination. Furthermore, there could be an interaction between race and nativity status on pay; The marginal effect of nativity status on pay could depend upon the level of racial discrimination.[5]

Compared to the literature on racial and gender discrimination, nationality discrimination has received very little attention. Two widely-cited expository surveys of the discrimination literature, Cain (1986) and Altonji and Blank (1999), make no mention of it.[6] The Appendix to this paper lists 23 studies on native-immigrant earnings differences that relate to nationality discrimination. These studies have four characteristics. First, only half make the identification of nationality discrimination the focus of inquiry. Second, nearly all of these studies lack any original theoretical model. We found only two studies, Bucci and Tenorio (1997) and Hayfron (2002), which articulate a theoretical model of native/immigrant wage differentials based on taste discrimination.[7] Those two models are very general and do not produce any novel implications that are carried over to an empirical specification. Third, most of the 23 studies listed in the Appendix do not address the potentially confounding effects of race or gender in the estimation of nationality discrimination.

[4] For example, the terrorist attacks of September 11, 2001, may have resulted in consumer discrimination against employers and their employees born in the Middle East.

[5] Nationality discrimination needs to be distinguished from "ethnic" discrimination. Ethnic discrimination is discrimination against persons of a particular ethnicity, or heritage, such as being Korean, Mexican, Italian, or having parents, grandparents, or ancestors from another country. One need not be foreign-born to experience ethnic discrimination. Nationality discrimination means that being native-born versus foreign-born makes a difference in how one is paid, all other things equal.

[6] Cain (1986) mentions "ethnic discrimination" only once (p. 1) and never mentions discrimination with respect to place of birth, whilst Altonji and Blank (1999) don't mention either type of discrimination.

[7] We should also mention a theoretical study by Müller (2003), who uses a dynamic efficiency wage model to derive a *ceteris paribus* wage gap between natives and immigrants. Müller assumes that migrants differ from natives only because migrants have a positive probability of return migration. Firms anticipate that migrants will have a greater chance of shirking, hence they are paid less.

The first analysis of earnings differences between foreign- and native-born workers that indicates possible nationality discrimination is Chiswick's (1978) pioneering study of U.S. immigrant assimilation. One of Chiswick's results, overshadowed by his evidence on immigrant assimilation, was a *ceteris paribus* earnings premium for immigrant males, as well as native/immigrant differences in rates of return to qualifications.[8] While Chiswick did not say that nationality discrimination contributes to native/immigrant differences in earnings,[9] he hinted at the possibility when he wrote (p. 908):

> "For the earnings of the foreign born to exceed the native born eventually suggests that the greater ability, work motivation, or investments in training of the foreign born more than offset *whatever earnings disadvantages persist from discrimination against them* or from their initially having less knowledge and skills relevant in U.S. labor markets" (our italics for emphasis).

Tandon (1978) reported evidence of structural differences in earnings between native- and foreign-born male residents of Toronto, but made no mention of discrimination as a factor. Similar types of results were obtained by Fujii and Mak (1983), who studied differences in earnings between 6 different ethnic groups in Hawaii. Neither of these studies control for race, though.[10] In a study of male U.K. immigrants, Chiswick (1980) found some evidence of a *ceteris paribus* earnings premium for immigrants. His results indicate that the size of the foreign/native earnings gap depends upon whether race is included as a control. Chiswick did not mention discrimination as a factor accounting for these results, though. Meng (1987) estimated Chiswick's model on Canadian data and found some evidence of a *ceteris paribus* earnings disadvantage for Canadian immigrants. However, like Chiswick, he did not draw any conclusions about whether this earnings gap indicated the presence of nationality discrimination.

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[8] For example, Chiswick found that the rate of return to education for an immigrant male was lower than for a native-born male.

[9] Chiswick said in a footnote (p. 899), that "The [native/immigrant] earnings gap would not close if a relevant knowledge deficiency persisted or if *there were discrimination against the foreign born in wages, employment, union membership, or occupational licensing.* On the other hand, *in some jobs there may be discrimination in favor of the foreign born (e.g. the French chef)*" (our italics for emphasis).

[10] It should be noted that while they lacked a race dummy in their empirical specifications, Fujii and Mak did distinguish Caucasians from members of five different non-Caucasian groups.

The first study to focus on identifying nationality discrimination is Haig's (1980) analysis of Australian panel data. While Haig's study has substantial data limitations that put his estimates at high risk of omitted variables bias,[11] his study has two important features. First, it is the first application of the Oaxaca (1973) and Blinder (1973) decomposition method to the measurement of nationality discrimination. Second, Haig recognized that racial and nationality discrimination may be correlated, hence the importance of controlling for both race and national origin when testing for nationality discrimination. Studying nearly 15,000 Australian males, he found that while immigrants earn about 6 percent more and have larger human capital endowments than natives, had they received the same returns to their human capital endowments as natives immigrants would have earned 9 percent more. Haig took this as evidence of a *ceteris paribus* earnings differential attributable to nationality discrimination of approximately 3 percent.

Reimers (1984) also recognized the importance of controlling for both race and nativity status in a study of native/immigrant earnings differences. She analyzed data for Hispanic men in the U.S., finding no evidence of *ceteris paribus* earnings differences between foreign-born Hispanics and native non-Hispanics, but some evidence indicating differences in rates of return to education and experience between the two groups. She made no mention of discrimination as a possible reason for these differences.

The first U.S. study to focus on identifying nationality discrimination is Gabriel and Schmitz's (1987) investigation of native and immigrant male earnings. Using data from the 1980 Census of Population and applying the decomposition method, they estimated two models which differ with respect to how the foreign-born earnings equation is specified. In their "basic" model, Gabriel and Schmitz have no controls for earnings assimilation, whereas in their "refined" model the foreign-born equation did include such controls. They found for the basic model that a relatively small proportion

[11] Haig measured experience by age, where age was only measured in intervals. Furthermore, his data set contains very little information on personal characteristics

(approximately 13%) of the native/immigrant mean earnings gap was attributable to discrimination against foreign-born workers. However, in their refined model, Gabriel and Schmitz observed an immigrant earnings premium. These conflicting results were taken as "…rather inconclusive evidence of earnings discrimination against foreign-born workers…" (p. 99).

The Gabriel and Schmitz (1987) did set a landmark in the literature because a larger proportion of subsequent studies made estimating nationality discrimination the focus, and the decomposition technique became the dominant empirical methodology for estimating nationality discrimination. Tran-Nam and Neville (1988), Daneshvary and Weber (1991), and Daneshvary (1993) used the decomposition method to provide evidence of discrimination against Australian immigrants (Tran-Nam and Neville) and U.S. immigrants (Daneshvary and Weber and Danehsvary). Beach and Worswick (1993), Shamsuddin (1998) and Hayfron (2002) estimated earnings equations which control for both gender and nationality. These authors argued that female immigrants can experience a "double negative effect" on earnings from gender discrimination and nationality discrimination. They provided evidence of this double negative effect in Canada (Beach and Worswick and Shamsuddin) and Norway (Hayfron). Kee (1995) studied nationality discrimination against Dutch immigrants, finding evidence of discrimination against members of several nationality groups.

Bucci and Tenorio (1997) used U.S. Census data to provide evidence of nepotism towards native-born workers. In a study of American and foreign-born scientists working in the U.S., Goyette and Xie (1999) reported that female immigrants are less likely to get hired and promoted than their immigrant male and native-born female counterparts They suggested that this may be a result of the "immigration path" (p. 407) taken by many female scientists and engineers, as wives of immigrant men. In a study of the Danish labor market, Nielsen, et al (2004) extended the decomposition technique to allow for the disentangling of the three sources of native-immigrant earnings differences discussed earlier. They found evidence of discrimination against female immigrants.

Three studies have tested for nationality discrimination in professional sports. Wilson and Ying (2003) tested for the effects of team nationality composition on fan attendance in the World's five largest football leagues. They found some evidence suggesting that employer discrimination is responsible for under-representation of various player nationalities. Pedace (2008) studied English soccer and found evidence of employer nepotism in favor of some South American players. Bodvarsson and Fuess (2008) studied Major League Baseball and found that foreign-born hitters subject to the *Reserve Clause* (players for whom the team owner has monopsony power) are disadvantaged in the bargaining process relative to American-born players, all other things equal. Unlike Pedace, Bodvarsson and Fuess control for the potentially confounding effects of race.

Our assessment of the aforementioned literature on nationality discrimination leads us to conclude the following. Nationality discrimination appears across a majority of studies to be an important contributor to immigrant earnings, especially for certain countries, nationality groups, and occupations. However, the literature lacks a theory of nationality discrimination that is capable of producing testable implications regarding the joint influences of native/immigrant productivity differences and discrimination. Furthermore, many of the data sets used in the previously discussed studies lack the breadth and depth of micro-data needed to produce accurate estimates of nationality discrimination. The goal of our research below is to resolve these deficiencies.

II. A theory of nationality discrimination

II.1 *The problem setting*

Suppose production is done using three inputs – units of native-born labor, units of foreign-born labor, and capital. Capital is assumed to be fixed. Native- and foreign-born workers are assumed to perform the same job assignment, but are imperfect substitutes. The imperfect substitutability arises from immigrant workers having acquired their skill sets in their home countries, where educational systems and labor markets are different. Differences in schooling, on-the-job-training, culture and traditions, etc., all contribute to differences in human capital endowments between natives and immigrants. To quote Ottaviano and Peri (2005), "Since foreign-born workers receive [at least part] of their education abroad, they are likely to retain different abilities pertaining to language, quantitative skills, and so on. Therefore they should be differentiated enough to be treated as imperfect substitutes for U.S.-born workers, *even within the same education and experience group"* (our italics for emphasis).[12]

Assume that technology is characterized by the Generalized Leontief Production function:[13]

$$Q = \sum_j \sum_i \gamma_{ij} [L_i (DL_j)]^{\frac{1}{2}} \qquad (\mathrm{i, j = N, I})$$
$$(1) \qquad = \gamma_{\mathrm{NN}} L_N + D^{\frac{1}{2}} [\gamma_{II} L_I + 2\gamma_{NI} (L_N L_I)^{\frac{1}{2}}],$$

where Q is output, L_N is the quantity of native-born labor, L_I is the quantity of immigrant labor, and γ_{ij} is a technology coefficient. Using an approach similar to Kahn (1991), we include the parameter D, $0 < D < 1$, above as a measure of the strength of customer prejudice against immigrant workers. Customer prejudice may be viewed as a situation where customers discount the marginal revenue product (MRP) of immigrant labor. The lower (higher) is D, the more (less) intense the prejudice and the lower (higher) is immigrant MRP.[14] If D equals 1, there is no prejudice. While a more traditional approach would be to think of customer discrimination as implying a price discount on the output of immigrant workers, the approach above is equivalent. The parameter D reflects the idea that immigrant labor input is valued less when customers are prejudiced. Note also that the above production function

[12] Ottaviano and Peri (2005, pp. 7-8).

[13] See Diewert (1971).

[14] Note that MRP of immigrant labor is $\frac{\partial Q}{\partial L_I} = D^{\frac{1}{2}} [\gamma_{II} + \gamma_{NI} (\frac{L_N}{L_I})^{\frac{1}{2}}]$. Under the assumption that employers only utilize that quantity of immigrant labor for which MRP is positive, requiring then that $\gamma_{II} + \gamma_{NI} (\frac{L_N}{L_I})^{\frac{1}{2}} > 0$, an increase in prejudice will unambiguously reduce immigrant MRP regardless of whether the two groups are substitutes or complements.

is constant returns to scale and imposes restrictions on each technology coefficient such that $\gamma_{ij} = \gamma_{ji}$. The sign of each technology coefficient indicates whether inputs i and j are substitutes ($\gamma_{ij} < 0$) or complements ($\gamma_{ij} > 0$).

We will assume that the product and labor markets are perfectly competitive and that product price is normalized at unity. Assume that r_N and r_I are the market wages of native- and foreign-born workers, respectively. The firm's profit function is thus

(2) $$\pi = \sum_j \sum_i \gamma_{ij} [L_i (DL_j)]^{\frac{1}{2}} - r_N L_N - r_I L_I, \text{ (i, j = N, I).}$$

If firms maximize profits and face constant input prices, the labor market will establish the following system of labor demand functions:

(3) $$r_N = \gamma_{NN} + \frac{1}{2} \gamma_{NI} D^{\frac{1}{2}} (\frac{L_I}{L_N})^{\frac{1}{2}}$$

(4) $$r_I = \gamma_{II} D + \frac{1}{2} \gamma_{NI} D^{\frac{1}{2}} (\frac{L_N}{L_I})^{\frac{1}{2}}$$

While equations (3) and (4) are not reduced form expressions, they provide some very useful implications. The wage paid to workers comprising a particular group depends upon four factors: (i) the productivities of workers in that group; (ii) the strength of customer prejudice against immigrant workers; (iii) the degrees of substitutability or complementarity between the two labor groups; and (iv) the relative supplies of labor in each group. For example, the immigrant wage (equation (4)) depends upon immigrant productivity (reflected by γ_{II})[15], prejudice (D), the degrees of substitutability or

[15] Note that γ_{II} is not precisely the marginal productivity of immigrants, but is correlated with it. If γ_{II} rises (falls), the marginal productivity curve will shift up (down). For example, an increase in γ_{II} could result from a technological advance, an increase in the average human capital endowment of each worker, or some other exogenous change.

complementarity between natives and immigrants (γ_{NI}), and the relative supply of native workers ($\frac{L_N}{L_I}$).

Equations (3) and (4) have immediate implications for how a change in the intensity of prejudice affects each group's wage. An increase in prejudice will always reduce the immigrant wage, but the effect on the native wage will depend upon whether the two groups are substitutes or complements. According to equation (3), if natives and immigrants are complements an increase in prejudice will reduce the native wage. The reason is that increased prejudice has the effect of reducing the benefits from complementarity; Immigrant MRP falls, leading to less employment of immigrants, which in turn reduces native MRP and less employment of the latter group. When natives and immigrants are substitutes, the lower immigrant MRP induces employers to substitute natives for immigrants, stimulating native employment and wages.

One particularly important insight from equations (3) and (4) is that the wage paid to workers of a particular group depends upon the amount of native/immigrant integration within and across groups. For example, according to equation (3), the wage paid to a native-born worker is affected by the number of immigrants per native. Furthermore, how natives are affected by an increase or a decrease in the number of immigrants depends upon both the technology coefficients and the intensity of prejudice against immigrants. If natives and immigrants are substitutes ($\gamma_{NI} < 0$), then if more immigrants are hired the wage paid to natives will fall, all other things equal. However, the drop in that wage will be smaller (larger) the greater (lesser) is the degree of customer prejudice against immigrants.[16] Thus, if natives and immigrants are substitutes, prejudice attenuates the adverse effects experienced by natives when more immigrants are hired and the degree of attenuation rises with the degree of prejudice. In

[16] When natives and immigrants are substitutes, $\frac{\partial^2 r_N}{\partial(\frac{L_I}{L_N})\partial D} < 0$ meaning that as customer prejudice rises, the drop in the wage paid to natives resulting from greater employment of immigrants will be less severe.

contrast, suppose that natives are complementary to immigrants ($\gamma_{NI} > 0$). Then an increase in the supply of immigrants will raise the wage paid to natives, all other things equal. However, the increase in that wage will be smaller (larger) the greater (lesser) is the degree of prejudice.[17] Natives benefit from having more immigrants, but prejudice effectively "taxes" that benefit.

There are similar implications for immigrant wages. If natives and immigrants are substitutes then greater employment of natives reduces the immigrant wage, but that wage falls less the greater is the amount of prejudice. Immigrant wages have less distance to fall in an environment of greater prejudice when relative employment of natives rises. In contrast, if the two group are complements, then greater hiring of natives will raise the wage of immigrants, but the wage rises less the greater is prejudice. This is an indirect adverse effect of prejudice on immigrants: Immigrants are harmed directly because customers value their output less, and indirectly because prejudice reduces the benefits enjoyed by immigrants from having a complementary relationship in production with natives.

The next step in the analysis is to extend Becker's (1971) *Market Discrimination Coefficient* (MDC) concept to the case of nationality discrimination when there is imperfect substitutability between the majority group and the minority group. The MDC in this case measures the percentage earnings premium paid to native workers due to being native-born. Applying Becker's (1971, p. 17) general version of the MDC to the case of nationality discrimination, the MDC is:[18]

$$(5) \qquad MDC_I^N = \frac{r_N(D<1)}{r_I(D<1)} - \frac{r_N(D=1)}{r_I(D=1)}$$

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[17] When natives and immigrants are complements $\dfrac{\partial^2 r_N}{\partial(\frac{L_I}{L_N})\partial D} > 0$, meaning that as customer prejudice falls, the gain in the wage paid to natives resulting from greater employment of immigrants will be larger.

[18] This expression is identical to Becker's general expression for the MDC, which he treats as the economy-wide wage gap when there is employment discrimination.

The first term on the right-hand side of (5) is the native/immigrant wage ratio when there is prejudice, whereas the second term is the ratio in the absence of prejudice. The difference between the two ratios measures the *ceteris paribus* (adjusted for differences in productivity) nationality pay gap. Using expressions (3) and (4), it follows that

$$(6) \qquad MDC_I^N = = \frac{\gamma_{NN} + \frac{1}{2}\gamma_{NI} D^{\frac{1}{2}} \left(\frac{L_I}{L_N}\right)^{\frac{1}{2}}}{\gamma_{II} D + \frac{1}{2}\gamma_{NI} D^{\frac{1}{2}} \left(\frac{L_N}{L_I}\right)^{\frac{1}{2}}} - \frac{\gamma_{NN} + \frac{1}{2}\gamma_{NI} \left(\frac{L_I}{L_N}\right)^{\frac{1}{2}}}{\gamma_{II} + \frac{1}{2}\gamma_{NI} \left(\frac{L_N}{L_I}\right)^{\frac{1}{2}}}.$$

According to equation (6), discrimination depends upon the strength of customer prejudice, native/immigrant productivity differences, the degree of substitutability or complementarity between natives and immigrants, and the relative supplies of native and immigrant labor.

Equation (6) provides some novel implications: We begin with a basic, intuitive one, though:

(i) *Nationality discrimination is larger the greater is the degree of customer prejudice*

<u>*Proof*</u>

Differentiating equation (6) with respect to the customer prejudice parameter (D), we obtain

$$(7) \quad \frac{\partial MDC_I^N}{\partial D} = \frac{\frac{1}{4}\gamma_{NI} D^{\frac{1}{4}} (\frac{L_I}{L_N})^{\frac{1}{2}}}{\left[\gamma_{II} D + \frac{1}{2}\gamma_{NI} D^{\frac{1}{2}} (\frac{L_N}{L_I})^{\frac{1}{2}}\right]^2} - \frac{(\gamma_{NN} + \frac{1}{2}\gamma_{NI} D^{\frac{1}{2}} (\frac{L_I}{L_N})^{\frac{1}{2}})(\gamma_{II} + \frac{1}{4}\gamma_{NI} D^{\frac{1}{4}} (\frac{L_N}{L_I})^{\frac{1}{2}})}{\gamma_{II} D + \frac{1}{2}\gamma_{NI} D^{\frac{1}{2}} (\frac{L_N}{L_I})^{\frac{1}{2}}}.$$

If the two groups of labor are substitutes ($\gamma_{NI} < 0$), then the first ratio to the right of the equal sign in expression (7) is negative. Since the second ratio is positive, expression (7) is guaranteed to be negative, meaning that a decrease in D (strengthening of customers' distaste for immigrants) raises the amount of market discrimination ($\frac{\partial MDC_I^N}{\partial D} < 0$). If the two groups are complements ($\gamma_{NI} > 0$), then expression (7) will also be negative. To see this, manipulation of expression (7) leads to the finding that

$$(8)\quad \frac{\partial MDC_I^N}{\partial D} > (<)\, 0 \text{ if } = \frac{1}{4}\gamma_{NI} D^{\frac{1}{4}} (\frac{L_I}{L_N})^{\frac{1}{2}} > (<)\, r_N r_I (\gamma_{II} + \frac{1}{4}\gamma_{NI} D^{\frac{1}{4}} (\frac{L_N}{L_I})^{\frac{1}{2}}).$$

Assuming that the product of the wages exceeds one and since $\gamma_{II} > 0$, the expression $\frac{1}{4}\gamma_{NI} D^{\frac{1}{4}} (\frac{L_I}{L_N})^{\frac{1}{2}}$ will be less than the expression to the right of it, hence $\frac{\partial MDC_I^N}{\partial D} < 0$.

The above prediction provides the foundation for another prediction, which is less intuitive, not implied by the standard discrimination model, and has very important empirical implications:

(ii) *The marginal effect of increased prejudice on nationality discrimination is less for higher-productivity immigrants.*

<u>*Proof*</u>

The productivity of immigrant labor is reflected in the intercept term (γ_{II}). If one differentiates expression (6) with respect to this intercept term, the following expression is obtained:

$$(9)\quad \frac{\partial^2 MDC_I^N}{\partial D \partial \gamma_{II}} = \frac{-D\left[\frac{1}{4}\gamma_{NI} D^{\frac{1}{4}} (\frac{L_I}{L_N})^{\frac{1}{2}}\right]}{\left[\gamma_{II} D + \frac{1}{2}\gamma_{NI} D^{\frac{1}{2}} (\frac{L_N}{L_I})^{\frac{1}{2}}\right]^3} - \frac{(\gamma_{NN} + \frac{1}{2}\gamma_{NI} D^{\frac{1}{2}} (\frac{L_I}{L_N})^{\frac{1}{2}})(\gamma_{II} + \frac{1}{4}\gamma_{NI} D^{\frac{1}{4}} (\frac{L_N}{L_I})^{\frac{1}{2}})}{\gamma_{II} D + \frac{1}{2}\gamma_{NI} D^{\frac{1}{2}} (\frac{L_N}{L_I})^{\frac{1}{2}}} - \frac{D\left[(\gamma_{NN} + \frac{1}{2}\gamma_{NI} D^{\frac{1}{2}} (\frac{L_I}{L_N})^{\frac{1}{2}})(\gamma_{II} + \frac{1}{4}\gamma_{NI} D^{\frac{1}{4}} (\frac{L_N}{L_I})^{\frac{1}{2}})\right]}{\left[\gamma_{II} D + \frac{1}{2}\gamma_{NI} D^{\frac{1}{2}} (\frac{L_N}{L_I})^{\frac{1}{2}}\right]^2}.$$

Using the guidelines for signing expression (8), expression (9) will be negative, meaning that the marginal effect of prejudice on the MDC declines as immigrant workers become more productive. What this means is that should there be an intensification of customer prejudice against immigrants, higher-productivity immigrants will experience less of an increase in discrimination than lower-productivity immigrants. There are several important implications here. First, race and productivity interact, something not implied by the standard discrimination model. Second, in an empirical specification where the goal is to estimate the extent of nationality discrimination, one must include an interaction term between race and productivity to avoid omitted variables bias.

There are two other predictions that relate to worker productivity:

(iii) *If immigrant workers become more productive, then pay discrimination against them falls*

<u>*Proof*</u>

Differentiating equation (6) with respect to γ_{II}, we obtain

$$(10)\ \frac{\partial MDC}{\partial \gamma_{II}} = \frac{-D\left[\gamma_{NN}+\frac{1}{2}\gamma_{NI}(\frac{L_I}{L_N})^{\frac{1}{2}}\right]}{\left[\gamma_{II}D+\frac{1}{2}\gamma_{NI}D^{\frac{1}{2}}(\frac{L_N}{L_I})^{\frac{1}{2}}\right]^2}+\frac{\left[\gamma_{NN}+\frac{1}{2}\gamma_{NI}\left(\frac{L_I}{L_N}\right)^{\frac{1}{2}}\right]}{\left[\gamma_{II}+\frac{1}{2}\gamma_{NI}\left(\frac{L_N}{L_I}\right)^{\frac{1}{2}}\right]^2}$$

, which is < (>) 0 as

$$(11)\ \frac{\gamma_{NN}+\frac{1}{2}\gamma_{NI}(\frac{L_I}{L_N})^{\frac{1}{2}}}{D\gamma_{NN}+\gamma_{NI}D^{\frac{3}{2}}(\frac{L_I}{L_N})^{\frac{1}{2}}} < (>)\ \frac{\left[\gamma_{II}+\frac{1}{2}\gamma_{NI}(\frac{L_N}{L_I})^{\frac{1}{2}}\right]^2}{\left[D\gamma_{II}+\frac{1}{2}\gamma_{NI}D^{\frac{1}{2}}(\frac{L_N}{L_I})^{\frac{1}{2}}\right]^2}.$$

Note that the ratio on the left-hand side of expression (11) is less than one, whilst the expression on the right-hand side exceeds one, guaranteeing that expression (11) is always negative. Regardless of the signs and magnitudes of the technology coefficients and the relative supplies of each labor type, nationality discrimination falls whenever immigrant labor improves its productivity. For example, a technological advance that makes immigrants more efficient results in less discrimination against them. In terms of the two wage ratios in expression (6), an increase in immigrant productivity causes the relative native wage with prejudice to fall and the wage without prejudice to fall as well, but the former falls proportionately more than the latter and there will be a net reduction in the MDC;

(iv) *If native workers become more productive, then discrimination against immigrants rises.*

An increase in native worker productivity is manifested by an increase in the intercept of the native marginal product function (γ_{NN}). Differentiating expression (6) with respect to this parameter, we obtain

$$(12)\quad \frac{\partial MDC_I^N}{\partial \gamma_{NN}} = \frac{1}{\gamma_{II} D + \gamma_{NI} D^{\frac{1}{2}} (\frac{L_N}{L_I})^{\frac{1}{2}}} - \frac{1}{\gamma_{II} + \gamma_{NI} (\frac{L_N}{L_I})^{\frac{1}{2}}} > 0.$$

The numerator in the first ratio on the right hand side of expression (12) is less than the numerator in the second ratio, guaranteeing that expression (12) is always positive. When native workers experience increases in productivity, their relative wage when there is prejudice against immigrants rises proportionately more than the wage in the absence of prejudice. The productivity increase has the unintended consequence of exacerbating the amount of discrimination directed towards immigrants.

The preceding two comparative static results have an important implication: When immigrants and natives are not perfect substitutes, the amount of market discrimination against immigrants depends upon relative productivity. Immigrants can help themselves overcome discrimination by boosting their productivities, e.g. through additional human capital investments, improved health and motivation, etc. There is also a policy implication: Public money used to train and educate immigrants in the host country could lead to reduced discrimination. However, there is an unintended consequence of improved productivity of native-born workers: If natives invest relatively more in their human capital endowments than immigrants, this will lead to more discrimination.

(v) *An increase in the relative supply of immigrants increases the amount of nationality discrimination*

<u>Proof</u>

An important property of the demand functions that are generated by the Generalized Leontief production function is that equilibrium factor prices depend upon relative factor supply. What does an increase in relative immigrant supply do to the MDC? Differentiating expression (6) with respect to relative immigrant supply, we obtain

$$(13)\quad \frac{\partial MDC_I^N}{\partial(\frac{L_I}{L_N})} = \frac{\frac{1}{4}\gamma_{NI} D^{\frac{1}{2}} \left(\frac{L_I}{L_N}\right)^{-\frac{1}{2}}}{\gamma_{II} D + \frac{1}{2}\gamma_{NI} D^{\frac{1}{2}} \left(\frac{L_N}{L_I}\right)^{\frac{1}{2}}} - \frac{\frac{1}{4}\gamma_{NI} \left(\frac{L_I}{L_N}\right)^{-\frac{1}{2}}}{\gamma_{II} + \frac{1}{2}\gamma_{NI} \left(\frac{L_N}{L_I}\right)^{\frac{1}{2}}}.$$

Assume that natives and immigrants are substitutes. Then, expression (13) will be negative (positive) if the first ratio to the right of the equal sign is greater in absolute value than the second ratio, i.e.

$$(14)\quad \frac{\partial MDC_I^N}{\partial(\frac{L_I}{L_N})} < (>)\ 0 \text{ if} \frac{1}{\gamma_{II} D^{\frac{1}{2}} + \frac{1}{2}\gamma_{NI} \left(\frac{L_N}{L_I}\right)^{\frac{1}{2}}} < (>) \frac{1}{\gamma_{II} + \frac{1}{2}\gamma_{NI} \left(\frac{L_N}{L_I}\right)^{\frac{1}{2}}}$$

Since D < 1, the expression $\frac{1}{\gamma_{II} D^{\frac{1}{2}} + \frac{1}{2}\gamma_{NI} \left(\frac{L_N}{L_I}\right)^{\frac{1}{2}}}$ is the larger one, confirming a negative sign for expression (14). The implication is that if residents of the host country harbor prejudice towards immigrants and there is an influx of new immigrants, there will be an increase in the amount of nationality discrimination. Conversely, the implication is that restrictive immigration policies will help to eradicate the extent of nationality discrimination.

III. A Test Case: Major League Baseball

III.1 *Description of the Test Case*

In this section, we test some implications of the above model. We chose an industry where: (a) there are very accurate data on salaries and productivities for individual workers; (b) there is a history of immigration and native/immigrant integration in the firm's work force; (c) worker race and gender can be observed; and (d) there is potential for customer discrimination. One industry satisfying all these criteria is Major League Baseball (MLB) in the USA.[19] In MLB, each team requires two distinctly complementary types of player skill - hitting (an offensive skill) and pitching (a defensive skill) - in the production of baseball entertainment. The industry has a long history of both immigration and racial integration. For many years, MLB has recruited players from Latin American countries, Canada, Australia, Japan, and other countries.

The ideal way to measure a Major League player's marginal revenue product (MRP) is by his contribution to the team's ticket, broadcasting and merchandise revenues. Because of the team production nature of baseball, however, it is impossible to empirically disentangle one player's revenue contribution from another. We thus proxy MRP by the player's years of MLB experience, tenure with his current team, and various career statistics (computed on a game-by-game basis since the beginning of the player's Major League career) that proxy his ability and skills. The career statistics we use to measure a hitter's productivity include *at bats*, *stolen bases*, *bases on balls*, *total bases*, *slugging average* and *batting average*.[20] We distinguish between hitters that are 'designated hitters' from those

[19] Discrimination in the professional sports labor market has received considerable attention among labor economists because of the abundant statistical evidence on a player's personal attributes, compensation and productivity. Most studies in this area have focused on racial discrimination with respect to pay, hiring, retention and positional segregation. For an examination of the research, see Kahn's (2000) expository survey.

[20] A player has an *at bat* every time he comes to bat, except in certain circumstances, e.g. if he is awarded first base due to interference or obstruction or the inning ends while he is still at bat. A hitter is assigned a stolen base (also called a 'steal') when he reaches an extra base on a hit from another player. For example, suppose that hitter A is at first base when hitter B hits the ball. Hitter B reaches first base (he would be assigned a 'single'), but hitter A reaches third base. Hitter A would be assigned a stolen base because he reached an extra base. A base on balls (also called a 'walk') is assigned when the batter receives four pitches which the umpire determines is a 'ball.' A ball is any pitch at which the batter does not swing and is

who are not. A designated hitter is a player who is chosen at the start of the game to bat in lieu of the pitcher in the lineup. We also distinguish, using dummies, between hitters that serve other types of positions. These include whether the hitter served as an infielder or a catcher.[21] We measure a pitcher's productivity by use of the following career statistics: *Wins*, *Losses*, *Games Started, Complete Games, Saves, Homeruns, Walks, Strikeouts, Innings Pitched, Earned Run Average (ERA,) and Strikeout Rate.*[22]

III. 2 *Empirical Analysis*

Our empirical analysis is set out in Tables 1-6. Tables 1 and 2 show descriptive statistics for hitters and pitchers, respectively. Our full sample comprises 1093 hitters (901 native, 192 immigrant; 549 white and 544 nonwhite) and 1203 pitchers (1031 native, 172 immigrant; 941 white and 262 nonwhite). Salary, experience, performance and position data were drawn from the *Lahman Baseball Database* (see: www.baseball1.com) over four seasons - 1992, 1993, 1997 and 1998. The salary data do not

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out of the 'strike zone' (which means it would not qualify to be a strike). When the hitter is assigned a base on balls, he is entitled to walk to first base. Total bases are the number of bases a player has gained through hitting. It is the sum of his hits weighted by 1 for a single, 2 for a double (if he gets to second base as a result of his hit), 3 for a triple (if he gets to third base) and 4 for a home run. A hitter's batting average is the ratio of hits to at bats; this measures the hitter's success rate. Slugging percentage, a related measure, reflects hitting power, which is total bases divided by at bats.

[21] An infielder is a defensive player who plays on the 'infield,' the dirt portion of a baseball diamond between first and third bases. The specific infielder positions are first baseman, second baseman, shortstop (which is between second and third bases) and third baseman. In contrast, an 'outfielder' plays farthest from the batter and his primary role is to catch long fly balls. Outfielder positions include left fielder, center fielder and right fielder. The catcher crouches behind home plate and receives the ball from the pitcher. Because the catcher can see the whole field, he is best positioned to lead and direct his fellow players in play. He typically calls the pitches by means of hand signals, hence requires awareness of both the pitcher's mechanics and the strengths and weaknesses of the batter.

[22] A pitcher is assigned a *win* or a *loss* depending on whether he was the *pitcher of record* when the decisive run was scored. One is the pitcher of record if one is the pitcher at the point when the player who scores the decisive run is allowed to reach a base. *Games started* is the number of times the pitcher was given the ball to start a game, whereas *games finished* is the number of times the pitcher was throwing on the mound during the final *out* (which is any failed attempt by a hitter to advance to a base). A *shutout* is a game in which one team does not score any runs. A pitcher earns a *save* if he is able to hold a lead for his team at the end of the game. Pitchers who earn saves, called *relievers*, tend not to gain wins, so it is customary to treat saves and wins equally, especially when studying pitcher salaries. Number of *home runs*, which is assumed to be negatively related to salary, is the number of pitches that were hit by batters which were scored as a home run. A pitcher is assigned a *walk*, which is assumed to be negatively related to salary, if he allows a batter to reach base after pitching him four balls. He is assigned a *strikeout* if he pitches three *strikes* (pitched balls counted against the batter, typically swung at and missed or fouled off) in a row. An *inning* is one of nine periods in a MLB game in which each team has a turn at bat; *innings pitched* is the number of such periods when the pitcher was working. *Earned run average* is negatively correlated with the pitcher's ability to prevent the opposing team from scoring. It equals the number of times the pitcher allows a batter to score a *run* (where the batter scores a point by advancing around the bases and reaching home plate safely) x 9, divided by the number of innings pitched. Finally the *strikeout rate* is the percentage of times the pitcher has succeeded in striking a batter out.

include information about contract length, bonus clauses or endorsements. Salaries for players on the Canadian teams were converted to U.S. dollars. The experience data were used to set controls for a player's eligibility for *free agency* and *final offer arbitration*.[23] The player's race was inferred from inspection of *Topps* baseball cards for all four seasons. For the U.S. teams, metropolitan area population and per-capita income were obtained from the website of the Bureau of Economic Analysis (see: www.bea.gov). For the Canadian teams, similar data were obtained from the Statistics Canada website (see: www.statcan.ca). Per-capita income data for the Canadian cities were converted to U.S. dollars.

It appears from Table 1 that immigrant hitters (who are overwhelmingly non-white) are generally quite similar to their native-born peers in terms of their personal characteristics and in terms of the types of markets in which they play. In terms of their professional characteristics, however, immigrants tend to have less MLB experience, less tenure with their current club, and are less likely to be eligible for final offer arbitration than their native-born counterparts. In terms of performance, immigrant hitters record fewer *At Bats*, *Stolen Base*s, *Bases on Balls* and *Total Bases* than native-born hitters, are less likely to be catchers, but more likely to be designated hitters.

It also appears from Table 1 that there are no major differences between the personal and professional characteristics of white and nonwhite hitters, nor in the characteristics of the greater metropolitan areas in which they play. In terms of career characteristics, however, nonwhite hitters record significantly more *At Bats*, *Stolen Bases* and *Total Bases* than white hitters. They are also less likely to play as an infielder or catcher, but are more likely to play as an outfielder or as a designated hitter.

[23] In MLB, player salaries are set under two regimes, one competitive, the other monopsonistic. The monopsonistic regime applies to players with fewer than six years of league experience. These players are subject to the reserve clause and are constrained to negotiate their pay with only one team. The competitive regime applies to players with at least 6 years of league experience. They are eligible to file for free agency and may negotiate with any team in the league. Monopsony power effectively begins to erode, however, as early as the fourth year because then a player is eligible for final offer arbitration. Arbitration rights tend to relieve players of monopsonistic exploitation because arbitrators strive to award competitive salaries. The Major League added new teams (called 'expansion teams') since the early 1990s, leading to a reduction in each team's monopsony power held over reserve clause players.

In Table 2, the domination of native and white pitchers is immediately apparent. Pitchers are predominately white natives – 78 percent of pitchers are white, 86 percent of pitchers are native, 89 percent of native pitchers are white, and 97 per cent of white pitchers are native. Relative to their non-white and immigrant counterparts, white and native pitchers enjoy higher average earnings, are generally older, have greater MLB experience and tenures with their current club, and are more likely to be free agents. In terms of career characteristics, white and native pitchers record significantly higher *Wins*, *Losses*, *Games Started*, *Complete Games*, *Shutouts*, *Saves*, *Homeruns*, *Walks*, *Strikeouts* and *Innings Pitched*.

We tested several implications of our theoretical model using OLS, the results of which are presented in Tables 3 and 4, where we set out earnings regressions for Hitters and Pitchers, respectively. Note that for the nativity status dummy ("Native"), the player is assigned a one if native-born and zero otherwise, as well as a one if white (and zero otherwise). We estimate six specifications *vis*. (1) All; (2) Natives; (3) Immigrants; (4) Whites; (5) Non-Whites; and (6) All with interactions between the nativity status dummy and the various productivity indicators.

Looking at Hitters first (Table 3), it is evident that the regressions are generally well specified, and that the coefficients on the explanatory variables are generally robust, across all the various specifications. Earnings are negatively related to *Age* but positively and concavely related to *MLB Experience*. It would appear that the negative coefficient on *Age* is reflecting the player's physical depreciation, whilst the positive coefficient on experience is reflecting rewards to greater human capital – indeed when we experimented with dropping age from our regressions we found that the coefficient on *MLB Experience* declined by almost exactly the size of the coefficient on *Age*. Earnings are also positively and significantly related to *Tenure with Current Club* and also to whether the player is a *Free Agent* or *Eligible for Final Offer Arbitration*. Career characteristics are dominated by the effects of a player's *Slugging* and *Batting Average*, although *At Bats* and *Stolen Bases* exert small, but significant effects on earnings.

Two implications of our model are that: (a) If there is discrimination against (in favor of) immigrants, the coefficient on the nativity status dummy will be positive (negative) and significant; and (b) productivity and nativity status will interact (the marginal effect of nativity status on pay depends upon how productive one is). For hitters, we found no evidence of differences in intercepts between natives and immigrants. Thus, hypothesis (a) is not confirmed for hitters. However, there is some evidence indicating confirmation of hypothesis (b) for the hitter group. Note from specification (6) of Table 3 that three of the nativity status x productivity interactions are significant, as are the interactions between nativity status and tenure with current club and with playing on a Canadian team.

Turning to pitchers (Table 4), we find – somewhat surprisingly – that *Age* impacts positively on the earnings of immigrant and nonwhite pitchers, *MLB Experience* impacts positively on the earnings of all pitchers and that *Tenure with Current Club* impacts positively upon the earnings of all but immigrant pitchers. The coefficients on the productivity variables generally accord to *a priori* expectations, although there are some noticeable discrepancies across the various sub-sample regressions. For example, the pay of non-white and immigrant, but not white or native, pitchers is significantly and positively related to *Wins*, and significantly and negatively related to *Games Started*. The pay of white, native and immigrant pitchers, but not non-white pitchers, is significantly and positively related to *Saves* whilst the pay of white and native, but not non-white or immigrant, pitchers is significantly and negatively related to *Shut Outs*, *Home Runs* and *ERA's*.

In terms of nationality discrimination within the pitcher group, our analysis confirms some implications of our theoretical model. There is evidence from Table 4 of reverse nationality discrimination for the pooled sample and for the subsample of non-white pitchers: In the pooled group, native-born pitchers make 10.3% less than their immigrant counterparts, all other things equal; In the non-white subsample, native-born pitchers make 19.4% less, all other things equal. This effect for the pooled sample falls away when the nativity status x productivity interactions are added in specification (6). Nevertheless, specification (6) indicates fairly substantial premia paid to immigrants, even after controlling for race. According to specification (6), four of the nativity status x productivity interactions are significant, again confirming the model's implication – perhaps more strongly for pitchers than for hitters - that the marginal effect of nativity status varies with productivity. Finally, we note that four of the nativity status x professional characteristics interactions are also significant

III. 3 *Decomposition Analysis*

In this section, we attempt to identify nationality discrimination using another empirical approach. The fact that players of a particular nativity group enjoy a mean wage differential over players of another nativity group could be a reflection of the former group's greater endowment of 'earning characteristics'. Native-born pitchers may, for example, be more productive or have more experience on average than immigrant pitchers. Alternatively, native-born pitchers may be better rewarded for the characteristics they do possess, suggesting some form of positive (negative) discrimination against native-born pitchers. To address this issue we perform a Blinder-Oaxaca decomposition to separate the native/immigrant mean earnings differential into an 'endowment component', to account for differences in endowments between individuals, and a 'price component', which is usually associated with discrimination.[24]

Assume that the earnings function of players of nativity j in position i is:

(15) $$\ln w^{ij} = \mathbf{X}^{ij}\mathbf{B}^{ij} + \varepsilon^{ij}$$

[24] This method of decomposition, initially proposed by Oaxaca (1973) and Blinder (1973), and later generalized by Oaxaca and Ransom (1994), has been applied extensively to discrimination on the basis of gender, race, caste and religion.

where $i = (N, I)$ and $j = (H, P)$ denote native and immigrant and pitchers and hitters respectively. $\mathbf{X}^{ij}$ denotes a vectors of explanatory variables, $\mathbf{B}^{ij}$ the corresponding coefficient vectors to be estimated, and ε^{ij} some well-behaved error term. Thus, the earnings functions of native-born pitchers, immigrant pitchers, native-born hitters and immigrant hitters may be denoted:

(16) $\ln w^{NH} = \mathbf{X}^{NH}\mathbf{B}^{NH} + \varepsilon^{NH}$

(17) $\ln w^{IH} = \mathbf{X}^{IH}\mathbf{B}^{IH} + \varepsilon^{IH}$

(18) $\ln w^{NP} = \mathbf{X}^{NP}\mathbf{B}^{NP} + \varepsilon^{NP}$

(19) $\ln w^{IP} = \mathbf{X}^{IP}\mathbf{B}^{IP} + \varepsilon^{IP}$

The Blinder-Oaxaca decomposition divides wage differentials into a part that is 'explained' by group differences in productivity and a residual part that cannot be accounted for by such differences in wage determinants. This latter 'unexplained' component is often used as a measure for discrimination. For example, the predicted average native hitter/immigrant hitter (NH-IH) differential may be represented as:

$$(20)\quad \begin{aligned} &\Delta \ln w^{NH-IH} = \ln w^{NH} - \ln w^{NNH} = \bar{\mathbf{X}}^{NH}\hat{\mathbf{B}}^{NH} - \bar{\mathbf{X}}^{IH}\hat{\mathbf{B}}^{IH} \\ &\Rightarrow \\ &\Delta \ln w^{NH-IH} = \hat{\mathbf{B}}^{IH}\left(\bar{\mathbf{X}}^{NH} - \bar{\mathbf{X}}^{IH}\right) + \bar{\mathbf{X}}^{NH}\left(\hat{\mathbf{B}}^{NH} - \hat{\mathbf{B}}^{IH}\right) \end{aligned}$$

The first term, $\hat{\mathbf{B}}^{IH}\left(\bar{\mathbf{X}}^{NH} - \bar{\mathbf{X}}^{IH}\right)$, represents differences in endowments between members of the two groups whilst the second term, $\bar{\mathbf{X}}^{NH}\left(\hat{\mathbf{B}}^{NH} - \hat{\mathbf{B}}^{IH}\right)$, represents differences in rewards. Note that if the overall differential is negative (i.e. $\Delta \ln w^{NH-IH} < 0$) but the second term is positive (i.e. $\bar{\mathbf{X}}^{NH}\left(\hat{\mathbf{B}}^{NH}-\hat{\mathbf{B}}^{IH}\right)>0$), then it would suggest that immigrant hitters are discriminated against despite earning, on average, more than native hitters. In other words, immigrant hitters would do even better with the earnings generating function of native hitters than with their own.

Specification (20) presumes that the immigrant hitter wage structure prevails in the absence of discrimination. But this is a matter of debate. Assuming away any feelings of malevolence or benevolence from one group towards the other, then it is equally valid to presume that the native hitter wage structure prevails, thereby requiring (20) to be re-specified as:

$$(21) \qquad \Delta \ln w^{NH-IH}=\hat{\mathbf{B}}^{NH}\left(\bar{\mathbf{X}}^{NH}-\bar{\mathbf{X}}^{IH}\right)+\bar{\mathbf{X}}^{IH}\left(\hat{\mathbf{B}}^{NH}-\hat{\mathbf{B}}^{IH}\right)$$

The first and second terms on the right hand side of (21) still represent differences in endowments and rewards respectively, but they will generally differ from those derived from equation (21).[25] Many authors concede this ambiguity by simply reporting both decompositions. Some researchers, however, have attempted to confront the issue head-on by hypothesizing the non-discriminatory parameter vector, $\bar{\mathbf{B}}$, directly.[26] Reimers (1983), for example, proposes using the average coefficients over both groups as an estimate of $\bar{\mathbf{B}}$. Neumark (1988) advocates using the coefficients from a pooled regression over both groups as an estimate of $\bar{\mathrm{B}}$. In what follows, we follow the 'hybrid' decomposition technique popularized by Cotton (1988) in which the prevailing non-discriminatory wage structure is assumed to be a weighted average of the wage structures of the two groups under consideration:

$$(22) \qquad \Delta \ln w^{NH-IH}=\bar{\mathbf{X}}^{NH}\left(\hat{\mathbf{B}}^{NH}-\bar{\mathbf{B}}\right)+\bar{\mathbf{X}}^{IH}\left(\bar{\mathbf{B}}-\hat{\mathbf{B}}^{IH}\right)+\bar{\mathbf{B}}\left(\bar{\mathbf{X}}^{NH}-\bar{\mathbf{X}}^{IH}\right)$$

[25] The point that an undervaluation of one group implies an overvaluation of the other is neatly summarized by Cotton (1988, p. 238): '… not only is the group discriminated against undervalued, but the preferred group is overvalued, and the undervaluation of the one subsidizes the overvaluation of the other.'

[26] Oaxaca and Ransom (1994) provide an integrative treatment of the various methods.

where $\bar{\mathbf{B}} = \mathbf{\Omega}\hat{\mathbf{B}}^{NH} + (1-\mathbf{\Omega})\hat{\mathbf{B}}^{IH}$ represents the estimated non-discriminatory parameter vector, with $\mathbf{\Omega}$ denoting the proportion of the sample comprised by native hitters. The first right-hand term in the decomposition is the overpayment enjoyed by native hitters, the second term is the underpayment suffered by immigrant hitters, and the third term is the portion of the wage differential that is explained by differences in endowments. We perform the above three decompositions for the native /immigrant hitter and native /immigrant pitcher differentials, and our results, based on the regressions set out in Tables 3-4, are collected in Tables 5 and 6.

Considering Table 5, our regression model implies a positive salary premium for native hitters over immigrant hitters *ceteris paribus*. The first two decompositions, which follow specifications (20) and (21), respectively, in presuming that the immigrant hitter and native hitter wage structure would prevail in the absence of any discrimination, suggests that this premium is predominately explained by endowments. Decomposition based on the immigrant hitter wage structure suggests that 95 per cent of the differential is attributable to the superior endowments of native hitters, with only 5 per cent being attributable to price effects. Decomposition based on the native hitter wage structure suggests that differences in endowments explain 86 per cent of the differential, with discrimination *against* native hitters reducing the wage differential by 14 per cent. The hybrid decomposition, derived from specification (22), echoes the finding that the differential is almost entirely endowment driven, with native hitter overpayment and immigrant hitter underpayment offsetting the potential native hitter wage premium by 0.75 per cent and 11.6 per cent, respectively. Thus, the decomposition results basically confirm the OLS results, namely that there is no compelling evidence of nationality discrimination either against or in favor of immigrant hitters.

Table 6 focuses on the native /immigrant pitcher differential, and the results here are in stark contrast to what we found from our OLS analyses. The decompositions based on both native pitcher and immigrant pitcher wage structures suggest that the substantially superior endowments of native pitchers are matched by equally substantial discrimination *against* immigrant pitchers, resulting in a negligible net potential wage differential. The hybrid decomposition suggests that it is the underpayment of immigrant pitchers, rather than the overpayment of native pitchers, that is acting to offset the endowment effect. In fact, the absolute value of the contribution of the immigrant underpayment to the native/immigrant mean earnings differential is almost the same as the contribution of the endowment effect. These results disconfirm the evidence from OLS, which indicated reverse discrimination.

IV. Concluding Remarks

Nationality discrimination is a particularly challenging type of discrimination to detect empirically because in most data sets of immigrants and natives, the effects of birthplace on pay will be influenced by productivity differences between natives and immigrants. This interrelatedness will occur anytime one is studying differences in pay between majority and minority workers when the two groups are imperfect substitutes. A very strong argument can be made for native/immigrant productivity differences because most immigrants need to assimilate to the host economy. If they also experience nationality discrimination, any theory and test of discrimination must account for the *joint* effects of birthplace and productivity differences. We suspect that most researchers have shied away from the study of nationality discrimination because of this problem of "disentangling," to use the language of Nielsen et al (2004).

In this paper, we have attempted to address the problem of how to measure nationality discrimination from both theoretical and empirical points of view. We developed a model of native/immigrant earnings differences that accounts for the joint effects of birthplace and productivity differences. Our key theoretical concept is an extension of Becker's traditional measure of discrimination, the Market Discrimination Coefficient (MDC), to the case of nationality discrimination when majority and minority workers are imperfect substitutes. Our MDC successfully allows one to tease out the contribution of productivity differences from the contribution of prejudice to the native/immigrant earnings wage gap. This has not done been done before theoretically and we contend that laying the theoretical groundwork is very helpful when it comes to designing an empirical specification. Our theoretical model produces a number of counterintuitive implications that are easily testable.

Another factor that has hampered the study of nationality discrimination in the past has been the absence of test cases that lend themselves well to estimating discrimination when there are majority/minority productivity differences. To test our model, we chose a particular industry that's very amenable to the study of nationality discrimination – Major League Baseball. Our examination of that industry yielded some very interesting results. First, we found evidence of nationality discrimination in the pitchers group – OLS results showing reverse discrimination and decompositions showing discrimination against immigrants. Because the decomposition technique is now generally recognized as the stronger, more informative, of the techniques for detecting discrimination, we are inclined to attach more credibility to the decompositions. The discrimination against immigrant pitchers we observe was quite substantial for the 1990s. However, we found no evidence of discrimination for or against hitters. This leads to a future research questions: Why, within the same industry, as well as within the same firm, does one observe discrimination in one occupation or job assignment and not in another?

Our empirical work also revealed confirmation of an important implication from our theory: Birthplace and productivity interact in the determination of pay. This is confirmation of a more general implication of our theory, which is that whenever majority and minority workers are imperfect substitutes in production, the personal attribute that is the focus of prejudice (race, gender, birthplace, etc.) will interact with relative productivity in influencing pay. Elsewhere (Bodvarsson and Sessions (2008)) we have found this to be true when studying racial discrimination across job assignments within the firm. Therefore, future studies of nationality discrimination, as well as studies of discrimination in general where majority and minority workers are not perfect substitutes, must take account of interaction effects between productivity and birthplace.

Now that a theory of nationality discrimination has been tested on a particular industry, the next step in this research area is to investigate discrimination for nationwide panel data sets. It will be interesting to see whether results from an inter-occupational nationwide study, particularly in countries where immigration is significant, will yield similar results to the ones found here. We hope our study spawns additional work in this area.

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Table 1: Descriptive Statistic - Hitters

	All		*Native*		*Immigrant*		*White*		*Non-White*	
Variable	*Mean*	*Std. Dev*	*Mean*	*Std. Dev*	*Mean*	*Std. Dev*	*Mean*	*Std. Dev*	*Mean*	*Std. Dev*
Personal Characteristics										
Log Annual Salary	13.890	1.13	13.882	1.11	13.923	1.21	13.865	1.10	13.914	1.16
Age	30.304	3.70	30.538	3.69	29.208	3.58	30.596	3.49	30.011	3.88
White	0.502	0.50	0.600	0.49	0.042	0.20	-	-	-	-
Non-White	0.498	0.50	0.400	0.49	0.958	0.20	-	-	-	-
Native	0.824	0.38	-	-	-	-	0.985	0.12	0.662	0.47
Immigrant	0.176	0.38	-	-	-	-	0.015	0.12	0.338	0.47
Professional Characteristics										
MLB Experience	7.061	3.89	7.099	3.94	6.885	3.63	7.062	3.87	7.061	3.91
MLB Experience-Squared	64.957	69.31	65.900	71.49	60.531	57.96	64.785	70.06	65.131	68.6
Tenure with Current Club	2.672	3.00	2.772	3.13	2.203	2.22	3.062	3.38	2.279	2.50
Free Agent	0.600	0.49	0.597	0.49	0.615	0.49	0.597	0.49	0.603	0.49
Eligible for Final Offer Arbitration	0.296	0.46	0.302	0.46	0.266	0.44	0.304	0.46	0.287	0.45
American League	0.514	0.50	0.498	0.50	0.589	0.49	0.521	0.50	0.507	0.50
National League	0.486	0.50	0.502	0.50	0.411	0.49	0.479	0.50	0.493	0.50
Canadian Team	0.073	0.26	0.060	0.24	0.135	0.34	0.067	0.25	0.079	0.27
Performance										
At Bats	2506.41	2001.58	2514.121	2042.69	2470.25	1800.64	2419.738	1940.51	2593.888	2059.46
Stolen Bases	69.746	112.52	70.825	119.51	64.693	71.11	44.800	72.35	94.925	137.54
Bases on Balls	254.275	247.74	263.865	258.01	209.271	186.42	253.131	233.32	255.428	261.69
Total Bases	1060.200	913.52	1066.499	934.2	1030.641	811.02	1016.772	880.39	1104.028	944.57
Slugging Average	0.407	0.06	0.408	0.06	0.401	0.07	0.404	0.06	0.410	0.07
Batting Average	0.267	0.03	0.267	0.02	0.266	0.02	0.264	0.02	0.269	0.02
Infielder	0.459	0.50	0.450	0.50	0.505	0.50	0.556	0.50	0.362	0.48
Outfielder	0.383	0.49	0.390	0.49	0.354	0.48	0.217	0.41	0.551	0.50
Catcher	0.116	0.32	0.122	0.33	0.089	0.28	0.189	0.39	0.042	0.20
Designated Hitter	0.059	0.24	0.054	0.23	0.078	0.27	0.046	0.21	0.072	0.26
Greater Metro Area Characteristics										
Percentage White	80.507	6.89	80.819	6.72	79.047	7.47	80.938	6.77	80.073	6.99
Percentage Black	13.273	6.58	13.312	6.61	13.086	6.47	12.959	6.6	13.589	6.56
Percentage Hispanic	10.621	10.65	10.559	10.69	10.913	10.45	10.719	10.8	10.522	10.50
Average Annual Income ($)	25562.99	3789.65	25514.71	3733.19	25789.51	4046.65	25508.57	3757.99	25617.9	3824
Population[1]	5514009	4657988	5412875	4595757	5988602	4924360	5313189	4509095	5716676	4799205
Year Dummies										
1992	0.250	0.43	0.251	0.43	0.245	0.43	0.255	0.44	0.244	0.43
1993	0.235	0.42	0.244	0.43	0.193	0.40	0.248	0.43	0.222	0.42
1997	0.260	0.44	0.255	0.44	0.281	0.45	0.248	0.43	0.272	0.45
1998	0.255	0.44	0.250	0.43	0.281	0.45	0.250	0.43	0.261	0.44
Sample Size	1093		901		192		549		544	

Note: 1. Population denotes the greater metro area population.

Source: All variables except Race and Greater Metro Area Characteristics (GMAC) extracted from the Lahman Baseball Database (Version 5.0, Release Date: Dec. 15, 2002). Race is derived form observed Topps Baseball Cards, years 92, 93, 94, 97, 99 (only years available). GMAC derived from the Statistical Abstract 1997-1999, the BEA, CA1-3, and from Statistical Canada..

Table 2: Descriptive Statistic - Pitchers

Variable	*All* Mean	*All* Std. Dev	*Native* Mean	*Native* Std. Dev	*Immigrant* Mean	*Immigrant* Std. Dev	*White* Mean	*White* Std. Dev	*Non-White* Mean	*Non-White* Std. Dev
Personal Characteristics										
Log Annual Salary	13.409	1.19	13.441	1.20	13.213	1.15	13.451	1.20	13.258	1.17
Age	29.815	4.09	30.102	4.06	28.093	3.85	30.19	4.02	28.466	4.05
White	0.782	0.41	0.885	0.32	0.169	0.38	-	-	-	-
Non-White	0.218	0.41	0.115	0.32	0.831	0.38	-	-	-	-
Native	0.857	0.35	-	-	-	-	0.969	0.17	0.454	0.50
Immigrant	0.143	0.35	-	-	-	-	0.031	0.17	0.546	0.50
Professional Characteristics										
MLB Experience	5.988	4.20	6.184	4.27	4.808	3.56	6.158	4.20	5.374	4.14
MLB Experience-Squared	53.468	76.64	56.43	78.98	35.692	57.85	55.562	78.38	45.939	69.64
Tenure with Current Club	1.924	2.07	1.955	2.11	1.738	1.85	1.935	2.10	1.885	1.98
Free Agent	0.467	0.50	0.485	0.50	0.355	0.48	0.482	0.50	0.412	0.49
Eligible for Final Offer Arbitration	0.306	0.46	0.300	0.46	0.343	0.48	0.314	0.46	0.279	0.45
American League	0.513	0.50	0.524	0.50	0.448	0.50	0.518	0.50	0.496	0.50
National League	0.487	0.50	0.476	0.50	0.552	0.50	0.482	0.50	0.504	0.50
Canadian Team	0.069	0.25	0.057	0.23	0.14	0.35	0.063	0.24	0.092	0.29
Performance										
Starter	0.442	0.50	0.436	0.50	0.477	0.50	0.441	0.50	0.447	0.50
Wins	37.446	44.33	39.124	45.39	27.378	35.82	39.007	45.27	31.832	40.37
Losses	34.179	37.05	35.593	37.86	25.692	30.50	35.904	38.37	27.973	31.13
Games Started	74.12	105.53	76.83	107.99	57.855	87.82	77.769	108.53	61.00	92.93
Complete Games	10.15	22.24	10.677	22.85	6.983	17.86	10.981	23.33	7.16	17.48
Shutouts	2.875	6.08	2.997	6.24	2.14	4.94	3.065	6.32	2.191	5.06
Saves	19.488	51.87	21.257	54.87	8.878	25.42	20.941	52.93	14.267	47.62
Homeruns	56.517	62.57	58.619	63.93	43.907	52.12	58.842	64.46	48.16	54.54
Walks	225.779	249.73	234.708	255.69	172.204	202.97	231.782	257.66	204.195	217.94
Strikeouts	436.641	514.13	456.643	531.38	316.628	374.42	450.726	530.21	386.00	448.86
Innings Pitched	627.592	702.42	653.705	716.96	470.919	585.76	655.16	720.78	528.473	623.3
ERA	4.025	0.96	4.004	0.95	4.152	1.00	3.995	0.94	4.133	1.04
Strikeout Rate	0.078	0.02	0.078	0.02	0.079	0.02	0.078	0.02	0.081	0.02
Greater Metro Area Characteristics										
Percentage White	80.714	6.84	80.647	6.84	81.116	6.84	80.695	6.91	80.782	6.58
Percentage Black	13.038	6.46	13.144	6.52	12.399	6.08	12.946	6.49	13.368	6.34
Percentage Hispanic	10.975	10.77	10.848	10.42	11.74	12.68	10.899	10.61	11.251	11.35
Average Annual Income ($)	25488.15	3939.85	25573.86	3875.25	24973.87	4283.28	25491.51	3895.3	25476.06	4103.68
Population[1]	5551948	4683874	5526000	4632204	5707635	4994077	5481401	4631793	5805594	4867179
Year Dummies										
1992	0.221	0.42	0.232	0.42	0.157	0.36	0.236	0.42	0.168	0.37
1993	0.239	0.43	0.25	0.43	0.174	0.38	0.248	0.43	0.206	0.41
1997	0.264	0.44	0.258	0.44	0.302	0.46	0.256	0.44	0.294	0.46
1998	0.276	0.45	0.261	0.44	13.213	1.15	0.26	0.44	0.332	0.47
Sample Size	1203		1031		172		942		262	

Note: 1. Population denotes the greater metro area population.
Source: All variables except Race and Greater Metro Area Characteristics (GMAC) extracted from the Lahman Baseball Database (Version 5.0, Release Date: Dec. 15, 2002). Race is derived form observed Topps Baseball Cards, years 92, 93, 94, 97, 99 (only years available). GMAC derived from the Statistical Abstract 1997-1999, the BEA, CA1-3, and from Statistical Canada..

Table 3: Log Annual Salary – Hitters

	(1) *All*		(2) *Native*		(3) *Immigrant*		(4) *White*		(5) *Non-White*		(6) *All* *Nativity* Productivity Interactions*			
Variable	*Mean*	*T-Stat*	*Mean*	*T-Stat*	*Mean*	*Mean*	*Mean*	*T-Stat*	*Mean*	*T-Stat*	*Mean*	*T-Stat*	*Mean*	*T-Stat*
Personal Characteristics														
Age	-0.046	-4.12	-0.047	-3.86	-0.029	-0.99	-0.065	-4.30	-0.023	-1.36	-0.044	-3.94	-	-
White	0.020	0.43	0.011	0.22	0.024	0.10	-	-	-	-	0.014	0.31	-	-
Non-White	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Native	-0.051	-0.92	-	-	-	-	-0.124	-0.38	-0.05	-0.87	0.193	0.26	-	-
Immigrant	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Professional Characteristics														
MLB Experience	0.317	7.24	0.330	6.89	0.279	2.75	0.356	6.06	0.294	5.47	0.276	3.00	0.051	0.50
MLB Experience-Squared	-0.021	-10.40	-0.021	-9.57	-0.023	-4.58	-0.021	-7.68	-0.023	-10.05	-0.226	-4.66	0.001	0.25
Tenure with Current Club	0.043	6.55	0.041	5.71	0.098	5.47	0.034	3.83	0.049	4.97	0.095	5.54	**-0.054**	**-2.94**
Free Agent	0.632	4.41	0.555	3.52	0.801	2.43	0.451	2.25	0.741	4.18	0.868	2.77	-0.309	-0.88
Eligible for Final Offer Arbitration	0.366	4.49	0.322	3.60	0.438	2.11	0.335	2.86	0.377	3.72	0.500	2.69	0.207	0.40
American League	-0.063	-1.65	-0.065	-1.53	-0.128	-1.34	-0.128	-2.38	-0.029	-0.51	-0.125	-1.43	0.058	0.59
Canadian Team	-0.070	-0.49	-0.216	-1.39	0.279	0.89	-0.238	-1.21	0.062	0.31	0.173	0.94	**-0.344**	**-2.17**
Performance														
At Bats	0.000	2.55	0.000	2.39	0.000	0.77	0.000	1.05	0.000	2.50	0.000	0.88	0.000	0.17
Stolen Bases	0.001	3.73	0.001	3.85	0.000	0.32	0.001	2.18	0.001	3.11	0.000	0.02	0.001	1.06
Bases on Balls	0.000	0.76	0.000	0.07	0.001	2.60	0.000	-0.08	0.000	2.12	0.001	2.77	**-0.001**	**-2.53**
Total Bases	0.000	1.42	0.000	1.10	0.000	1.11	0.000	1.34	0.000	0.86	0.000	1.18	-0.000	-0.58
Slugging Average	4.240	7.45	4.610	7.47	1.026	0.74	4.386	5.11	3.885	5.46	1.100	0.86	**3.518**	**2.53**
Batting Average	3.425	3.21	2.714	2.33	7.949	2.78	0.913	0.63	6.002	3.92	7.572	2.86	**-4.874**	**-1.70**
Infielder	0.026	0.14	0.011	0.05	-0.073	-0.20	-0.252	-0.83	0.066	0.30	-0.053	-0.15	0.063	0.15
Outfielder	-0.108	-0.59	-0.163	-0.75	0.01	0.03	-0.383	-1.25	-0.085	-0.38	0.027	0.08	-0.191	-0.49
Catcher	0.304	1.56	0.249	1.11	0.384	0.98	-0.02	-0.06	0.495	2.02	0.414	1.13	-0.167	-0.39
Designated Hitter	0.046	0.31	0.093	0.50	-0.15	-0.65	-0.196	-0.70	0.155	0.96	-0.163	-0.68	0.254	0.85
Greater Metro Area Characteristics														
Percentage White	0.004	0.84	0.001	0.16	0.011	0.92	0.002	0.21	0.003	0.48	0.003	0.71	-	-
Percentage Black	0.008	1.57	0.005	0.84	0.014	1.17	0.008	1.13	0.008	1.01	0.007	1.43	-	-
Percentage Hispanic	0.002	0.96	0.003	1.06	-0.003	-0.46	0.005	1.60	-0.001	-0.39	0.002	0.90	-	-
Average Annual Income ($)	0.000	0.87	0.000	0.45	0.000	0.44	0.000	0.47	0.000	0.94	0.000	0.77	-	-
Population1	0.000	-0.32	0.000	-0.35	0.000	0.51	0.000	-0.35	0.000	-0.03	0.000	-0.23	-	-
Year Dummies														
1992	0.069	1.31	0.067	1.15	0.139	1.12	0.048	0.61	0.091	1.26	0.075	3.14	-	-
1993	0.129	1.92	0.144	1.90	0.162	1.13	0.19	2.08	0.055	0.57	0.142	2.15	-	-
1997	0.208	2.83	0.240	2.84	0.241	1.50	0.215	2.23	0.176	1.64	0.230	3.14	-	-
Constant	9.515	12.96	10.001	11.75	8.283	5.46	11.249	9.68	8.344	8.46	9.418	10.37	-	-
R-Squared	0.7385		0.7280		0..8243		0.7266		0.7686		0.7465			
F-Statisitc	184.62 $_{28, 1064}$		150.05 $_{27, 873}$		53.24 $_{27, 164}$		94.28 $_{27, 521}$		102.36 $_{27, 516}$		125.26 $_{45, 1047}$			
Root Mean Squared Error	0.58452		0.5870		0.54901		0.58971		0.57091		0.58016			
Observations	1093		901		192		549		544		1093			

Table 4: Log Annual Salary – Pitchers

	(1) *All*		(2) *Native*		(3) *Immigrant*		(4) *White*		(5) *Non-White*		(6) *All* *Nativity* Productivity Interactions*			
Variable	*Mean*	*T-Stat*	*Mean*	*T-Stat*	*Mean*	*Mean*	*Mean*	*T-Stat*	*Mean*	*T-Stat*	*Mean*	*T-Stat*	*Mean*	*T-Stat*
Personal Characteristics														
Age	-0.002	-0.22	-0.013	-1.24	0.043	2.06	-0.017	-1.67	0.054	2.90	-0.002	-0.21	-	-
White	0.058	1.15	0.108	1.90	-0.197	-1.83	-	-	-	-	0.052	1.00	-	-
Non-White	-	-	-	-	-	-	-	-	-	-			-	-
Native	-0.103	-1.69	-	-	-	-	0.067	0.78	-0.194	-2.50	0.531	1.04	-	-
Immigrant														
Professional Characteristics														
MLB Experience	0.153	4.46	0.162	4.57	0.252	2.83	0.179	5.14	0.157	2.00	0.223	3.03	-0.077	-0.95
MLB Experience-Squared	-0.014	-9.37	-0.014	-9.08	-0.026	-7.03	-0.014	-9.13	-0.021	-6.52	-0.024	-8.51	**0.010**	**3.15**
Tenure with Current Club	0.068	7.46	0.068	7.08	0.016	0.59	0.064	6.44	0.064	3.08	0.020	0.89	**0.048**	**1.94**
Free Agent	0.739	6.05	0.800	6.17	-0.022	-0.08	0.761	5.83	0.418	1.51	0.127	0.50	**0.681**	**2.38**
Eligible for Final Offer Arbitration	0.421	6.37	0.470	6.73	-0.005	-0.03	0.47	6.53	0.143	1.06	0.013	0.09	**0.464**	**2.86**
American League	-0.009	-0.26	-0.019	-0.49	0.095	0.94	-0.028	-0.70	-0.015	-0.18	0.097	1.15	-0.118	-1.33
Canadian Team	-0.026	-0.21	0.036	0.25	0.160	0.67	-0.01	-0.07	0.208	0.82	0.060	0.39	-0.035	-0.27
Performance														
Starter	0.383	7.65	0.37	7.10	0.360	2.37	0.382	6.87	0.41	3.95	0.304	1.91	0.075	0.45
Wins	0.009	2.10	0.007	1.63	0.049	3.70	0.006	1.33	0.04	3.89	0.045	3.53	**-0.038**	**-2.84**
Losses	0.004	1.09	0.005	1.09	-0.009	-0.99	0.004	0.82	0.01	1.13	-0.019	-2.18	**0.024**	**2.53**
Games Started	-0.003	-2.38	-0.002	-1.54	-0.011	-2.44	-0.001	-0.76	-0.012	-4.37	-0.013	-2.40	**0.011**	**1.96**
Complete Games	0.001	0.38	0.002	0.71	-0.005	-0.35	0.001	0.48	-0.02	-1.80	-0.011	-0.93	0.014	1.15
Shutouts	-0.048	-4.41	-0.054	-4.52	-0.030	-0.84	-0.057	-4.65	0.003	0.09	-0.020	-0.58	-0.034	-0.92
Saves	0.003	3.50	0.002	3.33	0.005	1.98	0.003	4.15	0.001	0.33	0.005	2.39	-0.003	-1.17
Homeruns	-0.005	-3.71	-0.005	-3.74	-0.008	-1.46	-0.006	-3.80	-0.004	-0.89	-0.003	-0.07	-0.002	-0.48
Walks	0.000	-0.95	0.000	-1.23	0.000	0.08	-0.001	-1.54	0.000	0.23	0.000	0.13	-0.001	-0.49
Strikeouts	0.001	1.85	0.001	2.11	0.001	0.88	0.001	2.97	-0.002	-2.39	0.001	1.00	-0.000	-0.08
Innings Pitched	0.001	2.43	0.001	2.15	0.002	1.18	0.001	1.84	0.002	1.90	0.002	1.79	-0.001	-0.74
ERA	-0.131	-5.32	-0.138	-5.57	-0.025	-0.33	-0.150	-6.36	-0.025	-0.49	0.015	0.23	**-0.160**	**-2.29**
Strikeout Rate	5.590	4.15	5.682	4.28	0.498	0.17	5.588	4.14	7.846	2.86	4.054	1.33	1.415	0.44
Greater Metro Area Characteristics														
Percentage White	0.001	0.27	0.002	0.41	0.002	0.18	0.002	0.36	-0.001	-0.06	0.002	0.37	-	-
Percentage Black	0.005	0.97	0.006	1.16	0.008	0.70	0.005	0.96	0.008	0.74	0.006	1.20	-	-
Percentage Hispanic	0.005	2.66	0.005	2.52	0.005	1.00	0.005	2.31	0.008	1.69	0.005	2.51	-	-
Average Annual Income ($)	0.000	0.76	0.000	1.09	0.000	0.29	0.000	0.47	0.000	0.84	0.000	1.07	-	-
Population1	0.000	0.49	0.000	-0.42	0.000	0.91	0.000	0.90	0.000	-0.52	0.000	0.09	-	-
Year Dummies													-	-
1992	0.012	0.25	0.045	0.89	-0.251	-1.80	0.041	0.77	-0.099	-1.04	0.021	0.43	-	-
1993	0.126	2.10	0.098	1.50	0.19	1.30	0.127	1.90	0.021	0.15	0.116	1.94	-	-
1997	0.250	3.68	0.184	2.46	0.437	2.72	0.209	2.74	0.215	1.43	0.228	3.38	-	-
Constant	11.275	17.67	11.253	16.1	9.817	6.74	11.57	16.08	9.171	6.44	10.60	12.80	-	-
R-Squared	0.7848		0.7933		0.8396		0.7976		0.8092		0.796			
F-Statisitc	195.83 $_{31, 1171}$		190.83 $_{30, 1000}$		47.05 $_{30, 141}$		186.13 $_{30, 910}$		55.38 $_{30, 231}$		138.80 $_{51, 1151}$			
Root Mean Squared Error	0.56049		0.55222		0.50688		0.54665		0.54352		0.55039			
Observations	1203		1031		172		941		262		1203			

Table 5: Oaxaca-Cotton Decompositions: Native Hitter / Immigrant Hitter

$\Delta \ln w^{NH-IH} = \ln w^{NH} - \ln w^{IH}$

		Coef.	%
Native Hitter Wage Structure			
Endowment Effect:	$\hat{\mathbf{B}}^{NH}\left(\bar{\mathbf{X}}^{NH} - \bar{\mathbf{X}}^{IH}\right)$	6.031	*95.75*
Price Effect:	$\bar{\mathbf{X}}^{IH}\left(\hat{\mathbf{B}}^{NH} - \hat{\mathbf{B}}^{IH}\right)$	0.267	*4.25*
Total Differential:	$\hat{\mathbf{B}}^{NH}\left(\bar{\mathbf{X}}^{NH} - \bar{\mathbf{X}}^{IH}\right) + \bar{\mathbf{X}}^{IH}\left(\hat{\mathbf{B}}^{NH} - \hat{\mathbf{B}}^{IH}\right)$	6.298	*100.00*
Immigrant Hitter Wage Structure			
Endowment Effect:	$\hat{\mathbf{B}}^{IH}\left(\bar{\mathbf{X}}^{NH} - \bar{\mathbf{X}}^{IH}\right)$	7.183	*114.05*
Price Effect:	$\bar{\mathbf{X}}^{NH}\left(\hat{\mathbf{B}}^{NH} - \hat{\mathbf{B}}^{IH}\right)$	-0.885	*-14.05*
Total Differential:	$\hat{\mathbf{B}}^{IH}\left(\bar{\mathbf{X}}^{NH} - \bar{\mathbf{X}}^{IH}\right) + \bar{\mathbf{X}}^{NH}\left(\hat{\mathbf{B}}^{NH} - \hat{\mathbf{B}}^{IH}\right)$	6.298	*100.00*
Hybrid Wage Structure			
Native Hitter Overpayment:	$\bar{\mathbf{X}}^{NH}\left(\hat{\mathbf{B}}^{NH} - \bar{\mathbf{B}}\right)$	0.047	0.75
Immigrant Hitter Underpayment:	$\bar{\mathbf{X}}^{IH}\left(\bar{\mathbf{B}} - \hat{\mathbf{B}}^{IH}\right)$	-0.729	-11.58
Endowment Effect:	$\bar{\mathbf{B}}\left(\bar{\mathbf{X}}^{NH} - \bar{\mathbf{X}}^{IH}\right)$	6.980	110.83
Total Differential:	$\bar{\mathbf{X}}^{NH}\left(\hat{\mathbf{B}}^{NH} - \bar{\mathbf{B}}\right) + \bar{\mathbf{X}}^{IH}\left(\bar{\mathbf{B}} - \hat{\mathbf{B}}^{IH}\right) + \bar{\mathbf{B}}\left(\bar{\mathbf{X}}^{NH} - \bar{\mathbf{X}}^{IH}\right)$	6.298	100.00

Table 6: Oaxaca-Cotton Decompositions: Native Pitcher / Immigrant Pitcher

$\Delta \ln w^{IP} = \ln w^{NP} - \ln w^{IP}$

		Coef.	%
Native Pitcher Wage Structure			
Endowment Effect:	$\hat{\mathbf{B}}^{NP}\left(\bar{\mathbf{X}}^{NP} - \bar{\mathbf{X}}^{IP}\right)$	0.397	*-12527.91*
Price Effect:	$\bar{\mathbf{X}}^{IP}\left(\hat{\mathbf{B}}^{NP} - \hat{\mathbf{B}}^{IP}\right)$	-0.400	*12627.91*
Total Differential:	$\hat{\mathbf{B}}^{NP}\left(\bar{\mathbf{X}}^{NP} - \bar{\mathbf{X}}^{IP}\right) + \bar{\mathbf{X}}^{IP}\left(\hat{\mathbf{B}}^{NP} - \hat{\mathbf{B}}^{IP}\right)$	-0.003	*100.00*
Immigrant Pitcher Wage Structure			
Endowment Effect:	$\hat{\mathbf{B}}^{IP}\left(\bar{\mathbf{X}}^{NP} - \bar{\mathbf{X}}^{IH}\right)$	0.412	*13108.88*
Price Effect:	$\bar{\mathbf{X}}^{NP}\left(\hat{\mathbf{B}}^{NP} - \hat{\mathbf{B}}^{IP}\right)$	-0.415	*-13008.88*
Total Differential:	$\hat{\mathbf{B}}^{IP}\left(\bar{\mathbf{X}}^{NP} - \bar{\mathbf{X}}^{IP}\right) + \bar{\mathbf{X}}^{NP}\left(\hat{\mathbf{B}}^{NP} - \hat{\mathbf{B}}^{IP}\right)$	-0.003	*100.00*
Hybrid Wage Structure			
Native Pitcher Overpayment:	$\bar{\mathbf{X}}^{NP}\left(\hat{\mathbf{B}}^{NP} - \bar{\mathbf{B}}\right)$	-0.057	*1679.40*
Immigrant Pitcher Underpayment:	$\bar{\mathbf{X}}^{IP}\left(\bar{\mathbf{B}} - \hat{\mathbf{B}}^{IP}\right)$	-0.355	*10399.52*
Endowment Effect:	$\bar{\mathbf{B}}\left(\bar{\mathbf{X}}^{NP} - \bar{\mathbf{X}}^{IP}\right)$	0.409	*-11978.92*
Total Differential:	$\bar{\mathbf{X}}^{NP}\left(\hat{\mathbf{B}}^{NP} - \bar{\mathbf{B}}\right) + \bar{\mathbf{X}}^{IP}\left(\bar{\mathbf{B}} - \hat{\mathbf{B}}^{IP}\right) + \bar{\mathbf{B}}\left(\bar{\mathbf{X}}^{NP} - \bar{\mathbf{X}}^{IP}\right)$	-0.003	*100.00*